```python
#import libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from anyio.abc import value

df=pd.read_csv(r"C:\Users\sunit\Documents\DATA ANALYSTS\Python\Churn Analysis Project\Customer Churn.csv")
df.head(5)
```

```
   customerID  gender  SeniorCitizen Partner Dependents  tenure PhoneService  \
0  7590-VHVEG  Female              0     Yes         No       1           No
1  5575-GNVDE    Male              0      No         No      34          Yes
2  3668-QPYBK    Male              0      No         No       2          Yes
3  7795-CFOCW    Male              0      No         No      45           No
4  9237-HQITU  Female              0      No         No       2          Yes

      MultipleLines InternetService OnlineSecurity  ... DeviceProtection  \
0  No phone service             DSL             No  ...               No
1                No             DSL            Yes  ...              Yes
2                No             DSL            Yes  ...               No
3  No phone service             DSL            Yes  ...              Yes
4                No     Fiber optic             No  ...               No

  TechSupport StreamingTV StreamingMovies        Contract PaperlessBilling  \
0          No          No              No  Month-to-month              Yes
1          No          No              No        One year               No
2          No          No              No  Month-to-month              Yes
3         Yes          No              No        One year               No
4          No          No              No  Month-to-month              Yes
```

```
               PaymentMethod MonthlyCharges  TotalCharges Churn
0           Electronic check          29.85         29.85    No
1               Mailed check          56.95        1889.5    No
2               Mailed check          53.85        108.15   Yes
3  Bank transfer (automatic)          42.30       1840.75    No
4           Electronic check          70.70        151.65   Yes

[5 rows x 21 columns]
```

```
#data info
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7043 entries, 0 to 7042
Data columns (total 21 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   customerID        7043 non-null   object 
 1   gender            7043 non-null   object 
 2   SeniorCitizen     7043 non-null   int64  
 3   Partner           7043 non-null   object 
 4   Dependents        7043 non-null   object 
 5   tenure            7043 non-null   int64  
 6   PhoneService      7043 non-null   object 
 7   MultipleLines     7043 non-null   object 
 8   InternetService   7043 non-null   object 
 9   OnlineSecurity    7043 non-null   object 
 10  OnlineBackup      7043 non-null   object 
 11  DeviceProtection  7043 non-null   object 
 12  TechSupport       7043 non-null   object 
 13  StreamingTV       7043 non-null   object 
 14  StreamingMovies   7043 non-null   object 
 15  Contract          7043 non-null   object 
 16  PaperlessBilling  7043 non-null   object 
 17  PaymentMethod     7043 non-null   object 
 18  MonthlyCharges    7043 non-null   float64
 19  TotalCharges      7043 non-null   object 
 20  Churn             7043 non-null   object 
dtypes: float64(1), int64(2), object(18)
memory usage: 1.1+ MB
```

```
# lets convert totalcharges null rows into 0 and change its data type
from object to float
df["TotalCharges"]= df["TotalCharges"].replace(" ","0")
df["TotalCharges"]= df["TotalCharges"].astype("float")
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7043 entries, 0 to 7042
Data columns (total 21 columns):
```

```
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   customerID        7043 non-null   object 
 1   gender            7043 non-null   object 
 2   SeniorCitizen     7043 non-null   int64  
 3   Partner           7043 non-null   object 
 4   Dependents        7043 non-null   object 
 5   tenure            7043 non-null   int64  
 6   PhoneService      7043 non-null   object 
 7   MultipleLines     7043 non-null   object 
 8   InternetService   7043 non-null   object 
 9   OnlineSecurity    7043 non-null   object 
 10  OnlineBackup      7043 non-null   object 
 11  DeviceProtection  7043 non-null   object 
 12  TechSupport       7043 non-null   object 
 13  StreamingTV       7043 non-null   object 
 14  StreamingMovies   7043 non-null   object 
 15  Contract          7043 non-null   object 
 16  PaperlessBilling  7043 non-null   object 
 17  PaymentMethod     7043 non-null   object 
 18  MonthlyCharges    7043 non-null   float64
 19  TotalCharges      7043 non-null   float64
 20  Churn             7043 non-null   object 
dtypes: float64(2), int64(2), object(17)
memory usage: 1.1+ MB
```

```
#let's check null values in our data
df.isnull().sum()
```

```
customerID          0
gender              0
SeniorCitizen       0
Partner             0
Dependents          0
tenure              0
PhoneService        0
MultipleLines       0
InternetService     0
OnlineSecurity      0
OnlineBackup        0
DeviceProtection    0
TechSupport         0
StreamingTV         0
StreamingMovies     0
Contract            0
PaperlessBilling    0
PaymentMethod       0
MonthlyCharges      0
TotalCharges        0
```

```
Churn             0
dtype: int64
```

```
#and if we add one more .sum() it will sum it all
df.isnull().sum().sum()
```

```
0
```

```
#let's do descriptive analysis through describe function
df.describe()
```

```
       SeniorCitizen       tenure  MonthlyCharges  TotalCharges
count    7043.000000  7043.000000     7043.000000   7043.000000
mean        0.162147    32.371149       64.761692   2279.734304
std         0.368612    24.559481       30.090047   2266.794470
min         0.000000     0.000000       18.250000      0.000000
25%         0.000000     9.000000       35.500000    398.550000
50%         0.000000    29.000000       70.350000   1394.550000
75%         0.000000    55.000000       89.850000   3786.600000
max         1.000000    72.000000      118.750000   8684.800000
```

```
#let's check duplicates
df.duplicated().sum()
```

```
0
```

```
#lets check for customerID as it has unique values
df["customerID"].duplicated().sum()
```

```
0
```

```
#converted 0 and 1 values of senior citizen to yes/no to make it
easier to understand.
def conv(value):
    if value == 1:
        return "Yes"
    else:
        return "No"

df["SeniorCitizen"] = df["SeniorCitizen"].apply(conv)
df.head(50)
```

```
    customerID  gender SeniorCitizen Partner Dependents  tenure
PhoneService  \
0   7590-VHVEG  Female            No     Yes         No       1
No
1   5575-GNVDE    Male            No      No         No      34
Yes
2   3668-QPYBK    Male            No      No         No       2
Yes
3   7795-CFOCW    Male            No      No         No      45
No
```

```
4   9237-HQITU  Female              No       No           No        2
Yes
5   9305-CDSKC  Female              No       No           No        8
Yes
6   1452-KIOVK    Male              No       No          Yes       22
Yes
7   6713-OKOMC  Female              No       No           No       10
No
8   7892-POOKP  Female              No      Yes           No       28
Yes
9   6388-TABGU    Male              No       No          Yes       62
Yes
10  9763-GRSKD    Male              No      Yes          Yes       13
Yes
11  7469-LKBCI    Male              No       No           No       16
Yes
12  8091-TTVAX    Male              No      Yes           No       58
Yes
13  0280-XJGEX    Male              No       No           No       49
Yes
14  5129-JLPIS    Male              No       No           No       25
Yes
15  3655-SNQYZ  Female              No      Yes          Yes       69
Yes
16  8191-XWSZG  Female              No       No           No       52
Yes
17  9959-WOFKT    Male              No       No          Yes       71
Yes
18  4190-MFLUW  Female              No      Yes          Yes       10
Yes
19  4183-MYFRB  Female              No       No           No       21
Yes
20  8779-QRDMV    Male             Yes       No           No        1
No
21  1680-VDCWW    Male              No      Yes           No       12
Yes
22  1066-JKSGK    Male              No       No           No        1
Yes
23  3638-WEABW  Female              No      Yes           No       58
Yes
24  6322-HRPFA    Male              No      Yes          Yes       49
Yes
25  6865-JZNKO  Female              No       No           No       30
Yes
26  6467-CHFZW    Male              No      Yes          Yes       47
Yes
27  8665-UTDHZ    Male              No      Yes          Yes        1
No
28  5248-YGIJN    Male              No      Yes           No       72
```

```
Yes
29  8773-HHUOZ  Female            No       No         Yes       17
Yes
30  3841-NFECX  Female           Yes      Yes          No       71
Yes
31  4929-XIHVW    Male           Yes      Yes          No        2
Yes
32  6827-IEAUQ  Female            No      Yes         Yes       27
Yes
33  7310-EGVHZ    Male            No       No          No        1
Yes
34  3413-BMNZE    Male           Yes       No          No        1
Yes
35  6234-RAAPL  Female            No      Yes         Yes       72
Yes
36  6047-YHPVI    Male            No       No          No        5
Yes
37  6572-ADKRS  Female            No       No          No       46
Yes
38  5380-WJKOV    Male            No       No          No       34
Yes
39  8168-UQWWF  Female            No       No          No       11
Yes
40  8865-TNMNX    Male            No      Yes         Yes       10
Yes
41  9489-DEDVP  Female            No      Yes         Yes       70
Yes
42  9867-JCZSP  Female            No      Yes         Yes       17
Yes
43  4671-VJLCL  Female            No       No          No       63
Yes
44  4080-IIARD  Female            No      Yes          No       13
Yes
45  3714-NTNFO  Female            No       No          No       49
Yes
46  5948-UJZLF    Male            No       No          No        2
Yes
47  7760-OYPDY  Female            No       No          No        2
Yes
48  7639-LIAYI    Male            No       No          No       52
Yes
49  2954-PIBKO  Female            No      Yes         Yes       69
Yes

       MultipleLines InternetService       OnlineSecurity  ...  \
0   No phone service             DSL                   No  ...
1                 No             DSL                  Yes  ...
2                 No             DSL                  Yes  ...
3   No phone service             DSL                  Yes  ...
```

```
4                 No     Fiber optic                  No  ...
5                Yes     Fiber optic                  No  ...
6                Yes     Fiber optic                  No  ...
7   No phone service             DSL                 Yes  ...
8                Yes     Fiber optic                  No  ...
9                 No             DSL                 Yes  ...
10                No             DSL                 Yes  ...
11                No              No  No internet service  ...
12               Yes     Fiber optic                  No  ...
13               Yes     Fiber optic                  No  ...
14                No     Fiber optic                 Yes  ...
15               Yes     Fiber optic                 Yes  ...
16                No              No  No internet service  ...
17               Yes     Fiber optic                 Yes  ...
18                No             DSL                  No  ...
19                No     Fiber optic                  No  ...
20  No phone service             DSL                  No  ...
21                No              No  No internet service  ...
22                No              No  No internet service  ...
23               Yes             DSL                  No  ...
24                No             DSL                 Yes  ...
25                No             DSL                 Yes  ...
26               Yes     Fiber optic                  No  ...
27  No phone service             DSL                  No  ...
28               Yes             DSL                 Yes  ...
29                No             DSL                  No  ...
30               Yes     Fiber optic                 Yes  ...
31                No     Fiber optic                  No  ...
32                No             DSL                 Yes  ...
33                No              No  No internet service  ...
34                No             DSL                  No  ...
35               Yes     Fiber optic                 Yes  ...
36                No     Fiber optic                  No  ...
37                No     Fiber optic                  No  ...
38               Yes     Fiber optic                  No  ...
39               Yes     Fiber optic                  No  ...
40                No             DSL                  No  ...
41               Yes             DSL                 Yes  ...
42                No              No  No internet service  ...
43               Yes             DSL                 Yes  ...
44               Yes             DSL                 Yes  ...
45               Yes     Fiber optic                  No  ...
46                No             DSL                  No  ...
47                No     Fiber optic                  No  ...
48               Yes             DSL                 Yes  ...
49               Yes             DSL                 Yes  ...

      DeviceProtection          TechSupport          StreamingTV  \
0                   No                   No                   No
```

1	Yes	No	No
2	No	No	No
3	Yes	Yes	No
4	No	No	No
5	Yes	No	Yes
6	No	No	Yes
7	No	No	No
8	Yes	Yes	Yes
9	No	No	No
10	No	No	No
11	No internet service	No internet service	No internet service
12	Yes	No	Yes
13	Yes	No	Yes
14	Yes	Yes	Yes
15	Yes	Yes	Yes
16	No internet service	No internet service	No internet service
17	Yes	No	Yes
18	Yes	Yes	No
19	Yes	No	No
20	Yes	No	No
21	No internet service	No internet service	No internet service
22	No internet service	No internet service	No internet service
23	No	Yes	No
24	No	Yes	No
25	No	No	No
26	No	No	Yes
27	No	No	No
28	Yes	Yes	Yes
29	No	No	Yes
30	Yes	Yes	No
31	Yes	No	Yes
32	Yes	Yes	No
33	No internet service	No internet service	No internet service
34	No	No	No
35	No	Yes	Yes
36	No	No	No
37	Yes	No	No
38	Yes	No	Yes
39	Yes	No	Yes
40	No	No	No
41	No	No	Yes
42	No internet service	No internet service	No internet service
43	Yes	Yes	Yes
44	No	Yes	Yes
45	No	No	No
46	No	No	No
47	No	No	Yes
48	No	Yes	Yes
49	Yes	Yes	No

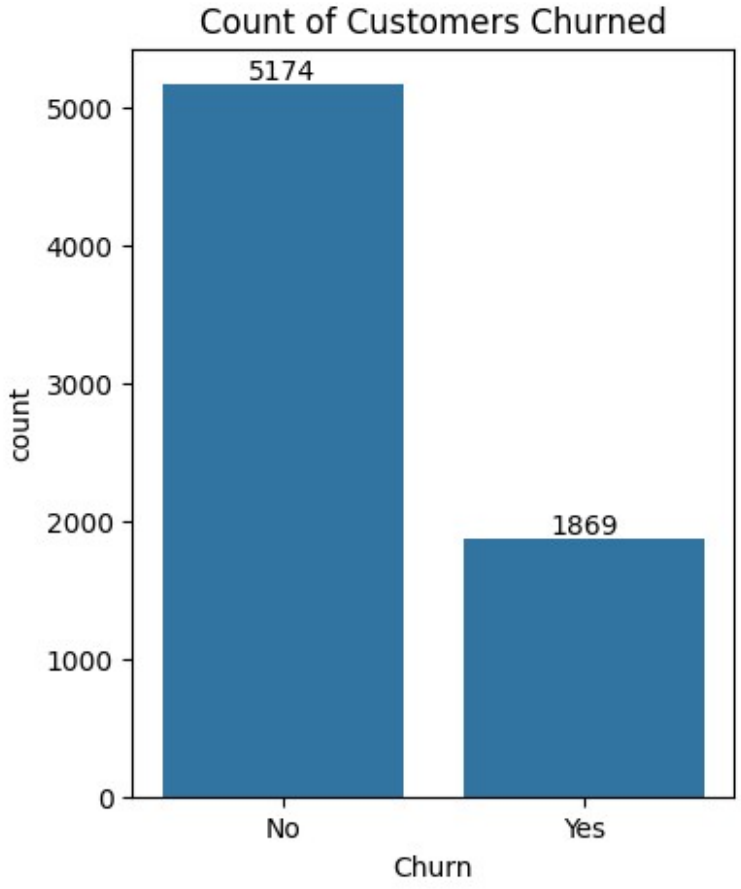
```
        StreamingMovies        Contract PaperlessBilling  \
0                    No  Month-to-month               Yes
1                    No        One year                No
2                    No  Month-to-month               Yes
3                    No        One year                No
4                    No  Month-to-month               Yes
5                   Yes  Month-to-month               Yes
6                    No  Month-to-month               Yes
7                    No  Month-to-month                No
8                   Yes  Month-to-month               Yes
9                    No        One year                No
10                   No  Month-to-month               Yes
11  No internet service        Two year                No
12                  Yes        One year                No
13                  Yes  Month-to-month               Yes
14                  Yes  Month-to-month               Yes
15                  Yes        Two year                No
16  No internet service        One year                No
17                  Yes        Two year                No
18                   No  Month-to-month                No
19                  Yes  Month-to-month               Yes
20                  Yes  Month-to-month               Yes
21  No internet service        One year                No
22  No internet service  Month-to-month                No
23                   No        Two year               Yes
24                   No  Month-to-month                No
25                   No  Month-to-month               Yes
26                  Yes  Month-to-month               Yes
27                   No  Month-to-month                No
28                  Yes        Two year               Yes
29                  Yes  Month-to-month               Yes
30                   No        Two year               Yes
31                  Yes  Month-to-month               Yes
32                   No        One year                No
33  No internet service  Month-to-month                No
34                   No  Month-to-month                No
35                   No        Two year                No
36                   No  Month-to-month               Yes
37                   No  Month-to-month               Yes
38                  Yes  Month-to-month               Yes
39                  Yes  Month-to-month               Yes
40                   No        One year                No
41                   No        Two year               Yes
42  No internet service        One year                No
43                   No        Two year               Yes
44                   No  Month-to-month               Yes
45                  Yes  Month-to-month               Yes
46                   No  Month-to-month                No
```

47	No	Month-to-month	Yes		
48	Yes	Two year	Yes		
49	No	Two year	Yes		

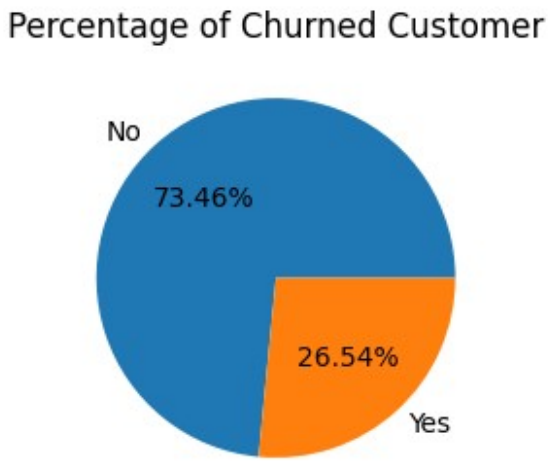
	PaymentMethod	MonthlyCharges	TotalCharges	Churn
0	Electronic check	29.85	29.85	No
1	Mailed check	56.95	1889.5	No
2	Mailed check	53.85	108.15	Yes
3	Bank transfer (automatic)	42.30	1840.75	No
4	Electronic check	70.70	151.65	Yes
5	Electronic check	99.65	820.5	Yes
6	Credit card (automatic)	89.10	1949.4	No
7	Mailed check	29.75	301.9	No
8	Electronic check	104.80	3046.05	Yes
9	Bank transfer (automatic)	56.15	3487.95	No
10	Mailed check	49.95	587.45	No
11	Credit card (automatic)	18.95	326.8	No
12	Credit card (automatic)	100.35	5681.1	No
13	Bank transfer (automatic)	103.70	5036.3	Yes
14	Electronic check	105.50	2686.05	No
15	Credit card (automatic)	113.25	7895.15	No
16	Mailed check	20.65	1022.95	No
17	Bank transfer (automatic)	106.70	7382.25	No
18	Credit card (automatic)	55.20	528.35	Yes
19	Electronic check	90.05	1862.9	No
20	Electronic check	39.65	39.65	Yes
21	Bank transfer (automatic)	19.80	202.25	No
22	Mailed check	20.15	20.15	Yes
23	Credit card (automatic)	59.90	3505.1	No
24	Credit card (automatic)	59.60	2970.3	No
25	Bank transfer (automatic)	55.30	1530.6	No
26	Electronic check	99.35	4749.15	Yes
27	Electronic check	30.20	30.2	Yes
28	Credit card (automatic)	90.25	6369.45	No
29	Mailed check	64.70	1093.1	Yes
30	Credit card (automatic)	96.35	6766.95	No
31	Credit card (automatic)	95.50	181.65	No
32	Mailed check	66.15	1874.45	No
33	Bank transfer (automatic)	20.20	20.2	No
34	Bank transfer (automatic)	45.25	45.25	No
35	Bank transfer (automatic)	99.90	7251.7	No
36	Electronic check	69.70	316.9	Yes
37	Credit card (automatic)	74.80	3548.3	No
38	Electronic check	106.35	3549.25	Yes
39	Bank transfer (automatic)	97.85	1105.4	Yes
40	Mailed check	49.55	475.7	No
41	Credit card (automatic)	69.20	4872.35	No
42	Mailed check	20.75	418.25	No
43	Credit card (automatic)	79.85	4861.45	No

```
44           Electronic check          76.20         981.45    No
45           Electronic check          84.50         3906.7    No
46               Mailed check          49.25             97    No
47           Electronic check          80.65         144.15   Yes
48    Credit card (automatic)          79.75         4217.8    No
49    Credit card (automatic)          64.15         4254.1    No

[50 rows x 21 columns]
```

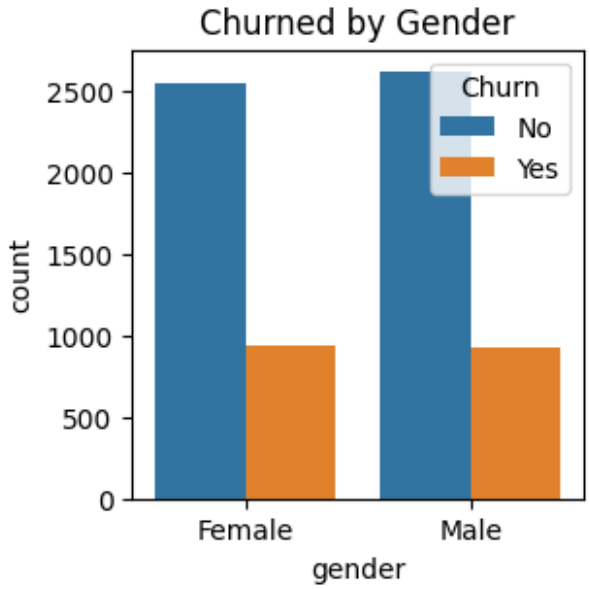
```
#let's check out how many customer churned out
plt.figure(figsize=(4,5))
ax = sns.countplot(x="Churn", data = df)
ax.bar_label(ax.containers[0])
plt.title("Count of Customers Churned")
plt.show()
```



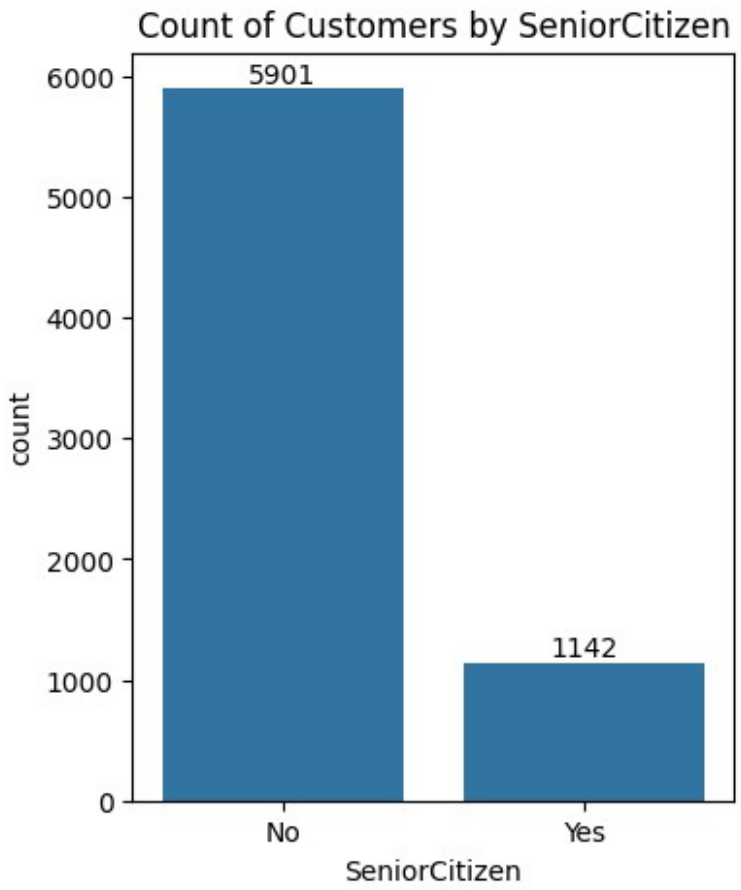

```
#Let's check the percentage of customers churned
plt.figure(figsize=(3,3))
gb = df.groupby("Churn").agg({"Churn":"count"})
plt.pie(gb["Churn"], labels = gb.index, autopct="%1.2f%%")
plt.title("Percentage of Churned Customer")
plt.show()
```



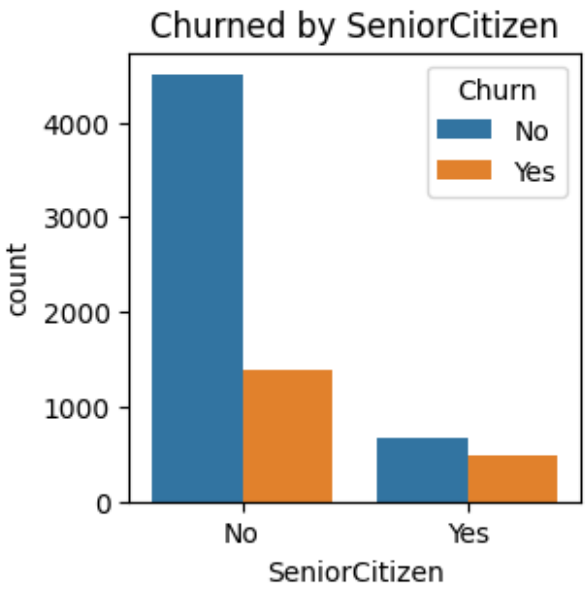

```
#let's explorer the reason behind the customer churned through gender
plt.figure(figsize=(3,3))
sns.countplot(x="gender",data = df,hue= "Churn")
plt.title("Churned by Gender")
plt.show()
```




```
#Lets count senior citizen
plt.figure(figsize=(4,5))
ax = sns.countplot(x="SeniorCitizen", data = df)
ax.bar_label(ax.containers[0])
plt.title("Count of Customers by SeniorCitizen")
plt.show()
```

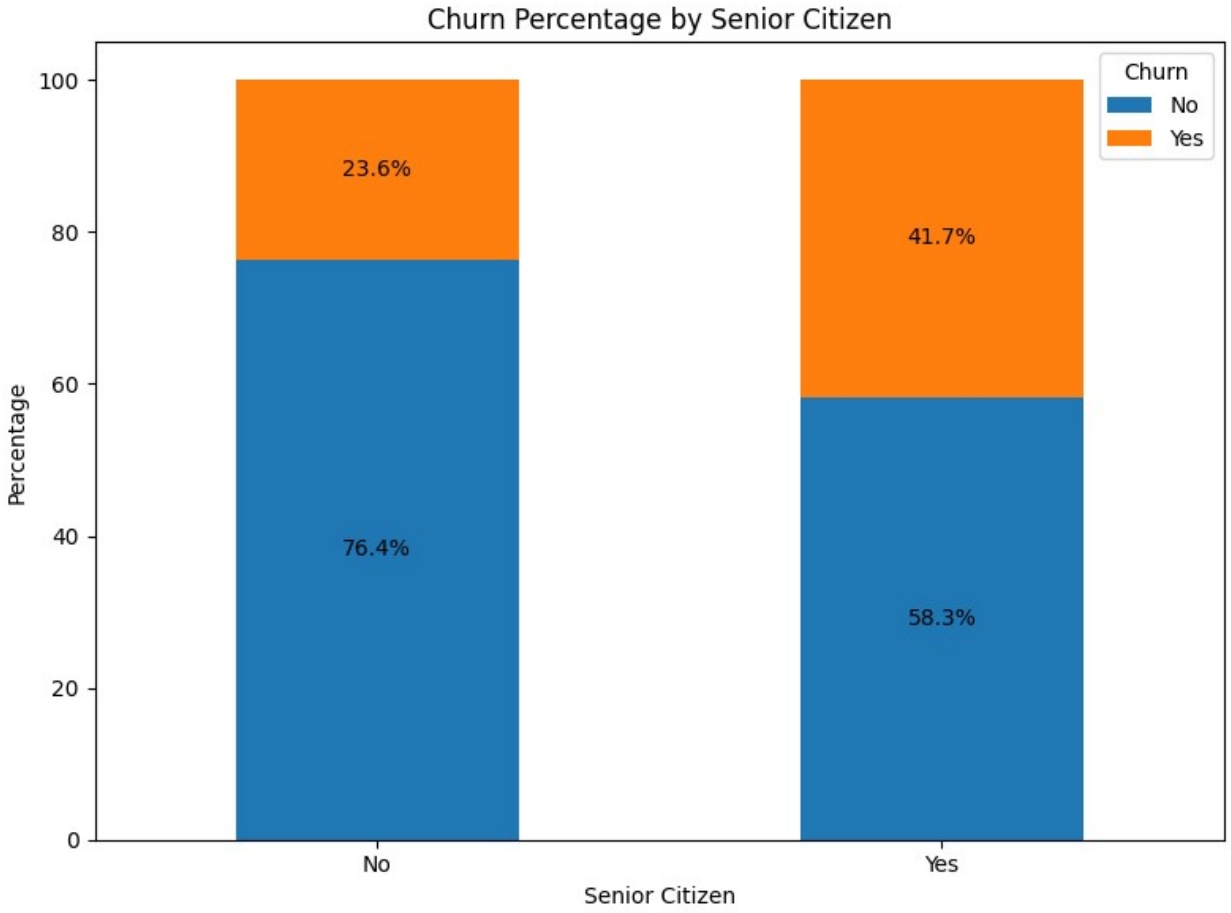



```
#let's check through Senior Citizen
plt.figure(figsize=(3,3))
sns.countplot(x="SeniorCitizen",data = df,hue= "Churn")
plt.title("Churned by SeniorCitizen")
plt.show()
```



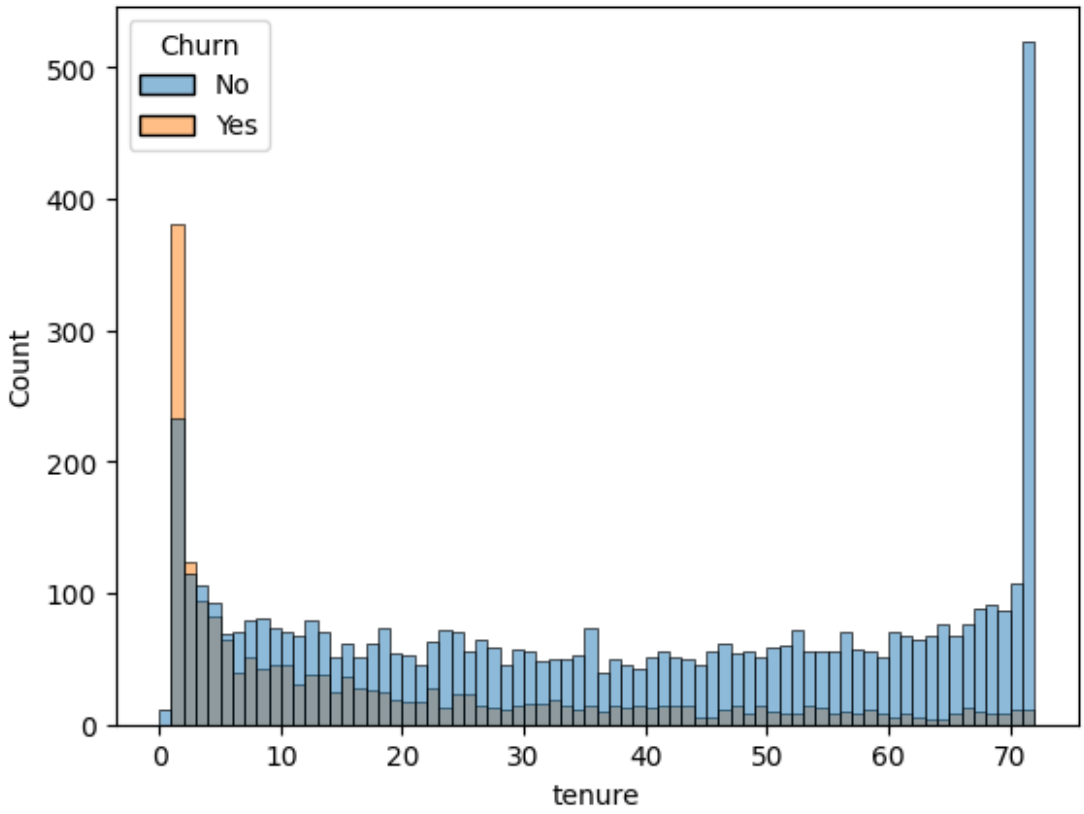

```
#Stacked bar chart with labels as %
grouped = df.groupby(["SeniorCitizen",
"Churn"]).size().unstack().fillna(0)
percent = grouped.div(grouped.sum(axis=1), axis=0) * 100  # convert to
percentages

#Step 1: Calculate percentage data
grouped = df.groupby(['SeniorCitizen',
'Churn']).size().unstack(fill_value=0)

#Step 2: Convert to percentages
percentages = grouped.div(grouped.sum(axis=1), axis=0) * 100

#Step 3: Plot
ax = percentages.plot(kind='bar', stacked=True, figsize=(8,6))

#Step 4: Add labels on bars
for i, row in enumerate(percentages.values):
    cumulative = 0
    for j, val in enumerate(row):
        if val > 0:
            plt.text(i, cumulative + val/2, f'{val:.1f}%',
ha='center', va='center', fontsize=10)
            cumulative += val

plt.title("Churn Percentage by Senior Citizen")
plt.ylabel("Percentage")
plt.xlabel("Senior Citizen")
plt.xticks(rotation=0)
plt.legend(title="Churn")
```

```
plt.tight_layout()
plt.show()
```



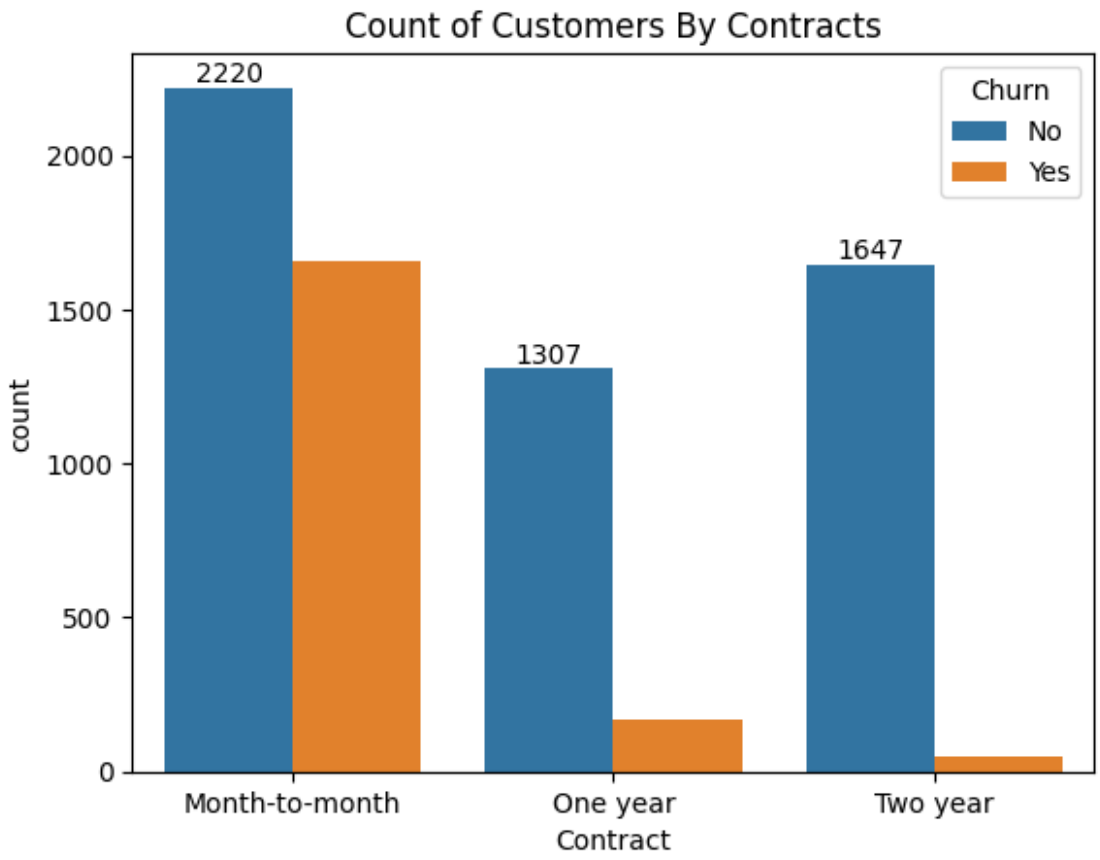
#Comparetively a greater percentage of people in senior citizen category have churned.

```
# Let's check the churned rate on the basis of tenure
sns.histplot(x="tenure",data=df,hue="Churn",bins=72)
plt.show()
```



#people who have used our services for a long time have stayed and people who have used our services for 1 or 2 months have churned out.

```
#Let's count the customers on the basis of contract.
ax = sns.countplot(x="Contract", data = df,hue="Churn")
ax.bar_label(ax.containers[0])
plt.title("Count of Customers By Contracts")
plt.show()
```



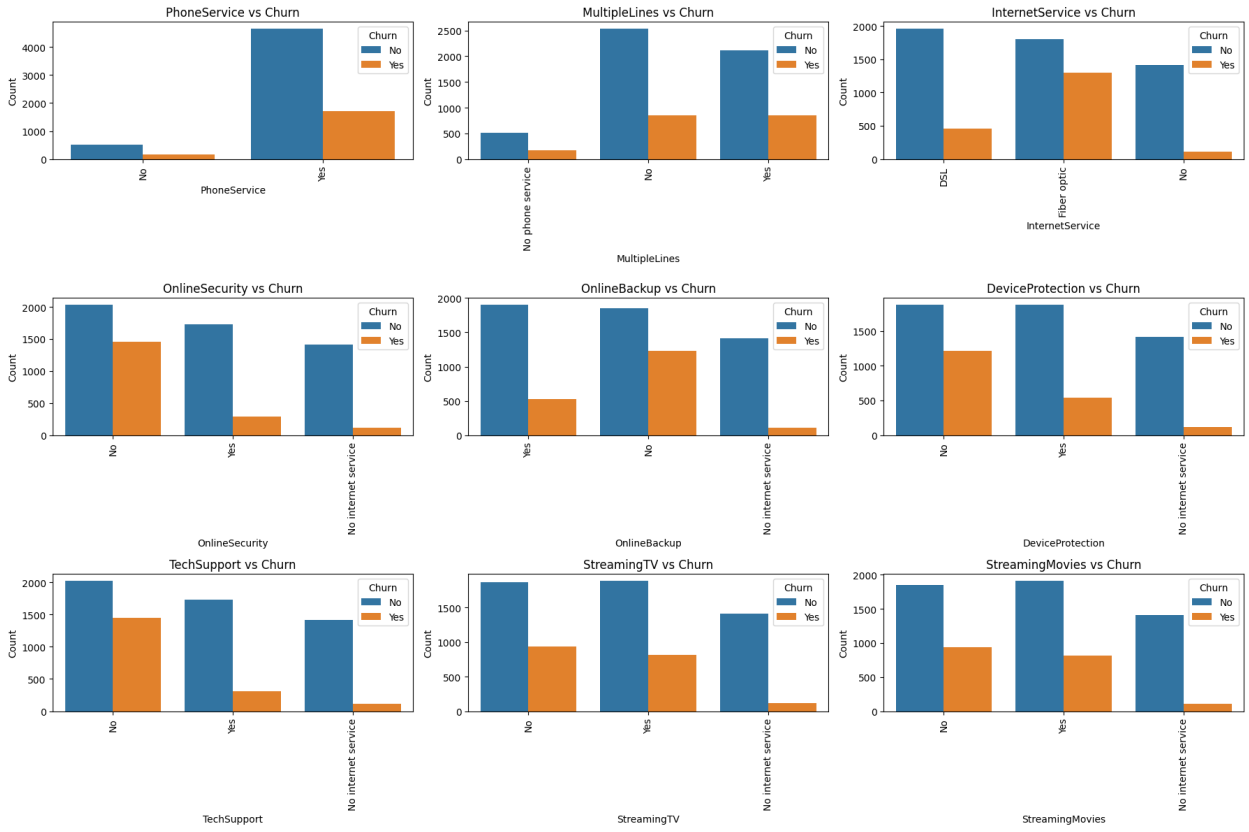
#people who have month to month contract are likely to churn then from those who have 1 or 2 years of contract.

```
df.columns.values
```

```
array(['customerID', 'gender', 'SeniorCitizen', 'Partner',
'Dependents',
       'tenure', 'PhoneService', 'MultipleLines', 'InternetService',
       'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
       'TechSupport', 'StreamingTV', 'StreamingMovies', 'Contract',
       'PaperlessBilling', 'PaymentMethod', 'MonthlyCharges',
       'TotalCharges', 'Churn'], dtype=object)
```

```
# Lets create subplots for all the services provide to the customers
and check its churn rate
# List of columns you want to plot
cols = [
    'PhoneService', 'MultipleLines', 'InternetService',
'OnlineSecurity',
    'OnlineBackup', 'DeviceProtection', 'TechSupport',
    'StreamingTV', 'StreamingMovies'
]

# Set up the subplot grid
```

```
n_cols = 3  # Number of columns in subplot grid
n_rows = (len(cols) + n_cols - 1) // n_cols  # Auto-adjust rows

plt.figure(figsize=(18, n_rows * 4))  # Adjust figure size based on rows

# Loop through columns and create countplots
for idx, col in enumerate(cols, 1):
    plt.subplot(n_rows, n_cols, idx)
    sns.countplot(x=col, data=df, hue='Churn')
    plt.title(f'{col} vs Churn')
    plt.xlabel(col)
    plt.ylabel('Count')
    plt.xticks(rotation=90)

plt.tight_layout()
plt.show()
```



#The visualizations show that customers lacking services like OnlineSecurity, TechSupport, DeviceProtection, and Streaming options are more likely to churn. Notably, those with fiber-optic internet have higher churn compared to DSL users. Overall, customers who subscribed to more value-added services tended to be more loyal, suggesting that bundling or promoting these services could improve retention.

```
#Let's count the churned customers on the basis of payment method.
ax = sns.countplot(x="PaymentMethod", data = df,hue="Churn")
ax.bar_label(ax.containers[0])
ax.bar_label(ax.containers[1])
plt.title("Churned Customers By PaymentMethod")
plt.xticks(rotation=45)
plt.show()
```